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ILLUSTRATED CATALOGUE OF THE MILWAUKEE ELECTRIC MANUFACTURING CO.

MANUFACTURERS OF ELECTRIC SPECIALTIES,

ELECTRO-PLATING MACHINES,
ELECTRIC VALVES, ETC.

MILWAUKEE, WIS.

J. KNAUBER & CO. LITH. MILWAUKEE.

ILLUSTRATED CATALOGUE

OF

THE MILWAUKEE

Electric Manufacturing

COMPANY.

DIVISION C.

Electric Valves.

MILWAUKEE, WIS.

1884.

MILWAUKEE:
BURDICK & ARMITAGE, PRINTERS,
410 & 412 Broadway.
1884.

THE ELECTRIC VALVE.

General Description.

We have the pleasure of presenting to the public an invention, which, in its general usefulness, exceeds anything which has been brought to the World's notice since the telephone was invented. The Electric Valve, or more properly the Electro-Pneumatic Valve, is the result of a long series of investigation and experiment carried on in our laboratory by our electrician, Mr. W. S. Johnson. Starting with the knowledge that such a device was not only desirable, but in some cases absolutely necessary to secure proper results, through many steps and many failures success was at last reached. Like nearly all useful inventions, the Electric Valve is very simple, and the wonder is that it was not invented before. It contains no complicated mechanism; in fact, the only movable part, except the valve stem in the valve itself, is a single lever, which moves less than *one-sixteenth* of an inch. In order to make it clearly understood, we will proceed to illustrate its principles.

If an attempt is made to close or open a valve, such as is found on steam pipes, by the direct agency of electricity, it will be found that there is required an immense battery to do the work, so large a battery, in fact, that it will be entirely impracticable. Many devices have been made to close valves by clock-work, that is, valves on air pipes or the draughts of furnaces; the electricity in these cases serving to set the clock-work in motion. The failure of these valves has arisen from two causes—first, because only small and easily moved valves could be operated, and second, because even in these cases the mechanism was large, complicated, and expensive. To our knowledge, the operation of all valves, of *any* size and under *any* pressure, by means of a current of electricity has not before been attempted, or if attempted, has not succeeded.

In order to get the required force for operating valves of any size, we use compressed air, which acts directly upon a piston, or its equivalent, and operates the valve. In this case the electricity has only the simple duty of

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admitting or releasing the compressed air from the chamber that operates the piston. A very feeble current of electricity serves for this purpose, and what is more, the same quantity of electricity will operate the *largest valve in the world* as easily as it will operate the smallest. A *single cell* of any battery will stop the largest engine which is built. The compressed air is stored in a small tank, which is filled as occasion requires by means of a small air pump. For ordinary buildings *one minute's* work per day will compress sufficient air to operate all of the valves. The air tank is kept in some convenient place from which small pipes lead to the valves to be operated. Usually we use *one-eighth* inch gas pipe.

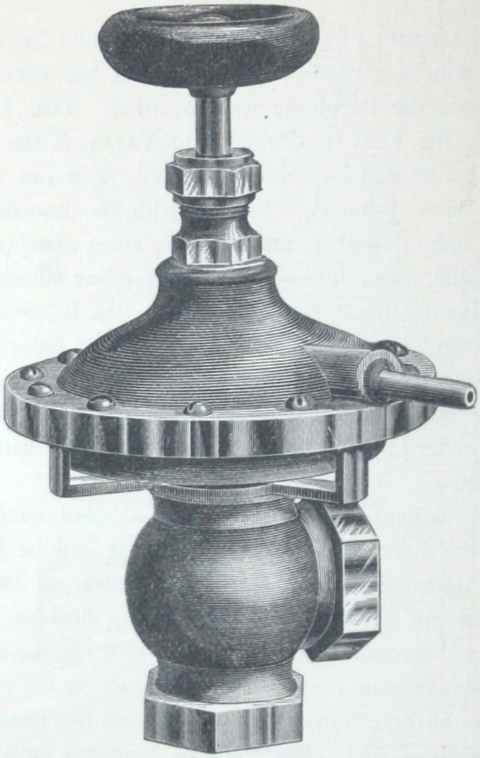

Fig. 1. Diaphragm Valve.

In order to more clearly explain the working of this apparatus we will employ cuts of parts of the apparatus.

The above valve is used on all pipes upon steam, water, or brine systems. It consists of an ordinary valve body, connected with an expansible diaphragm, which serves to close the valve in the valve body. This will be better understood by the following sectional view of the diaphragm valve :

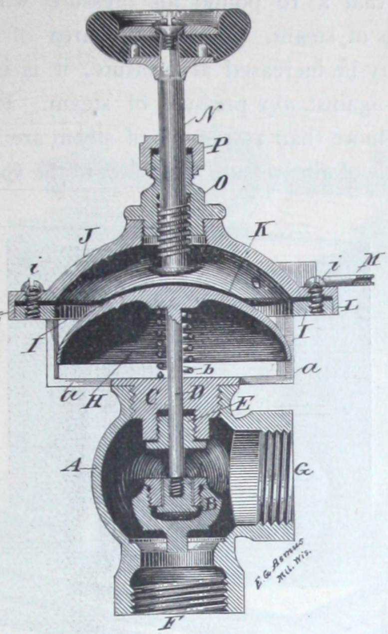

Fig. 2. Sectional View of Diaphragm Valve.

A is the valve body; B the valve disc; C the packing box through which the stem passes; H is a saucer-shaped piece, fastened to the upper end of the stem D. The valve is held open by the steel spring *b*, which presses upward on the saucer H. Above this saucer H is the umbrella-shapped piece J, held by the standards *a*, *a*. Upon the under side of the piece J, and fastened firmly to its edges to produce an air-tight joint, is the flexible diaphragm K, made of cloth and rubber. There is an opening through the pipe M into the chamber formed between the metal piece J and the diaphragm K. It is easily seen that if air, under pressure, is admitted through the opening M that the valve will be pushed downward to its seat. When the air is allowed to escape from above K, the spring *b* will open the valve B to its full extent.

To show with what force the valve is seated, let us suppose that 60 pounds of steam are being carried, and that B is an inch valve. In this case the area of B is .78 of an inch, and the steam pressure upon it is 47 pounds, the area of the diaphragm K, as we make it for one inch valves, is nine square inches. If the air pressure is 10 pounds per square inch, the valve B will be seated with a force of 90 pounds, which is 43 pounds in *excess* of the steam pressure. If we allow 10 pounds as a sufficient excess of pressure of

air it will be seen that a 10 pound air pressure will operate the valve B against 100 pounds of steam. As both the area of the diaphragm K and the air pressure may be increased at pleasure, it is evident that the valve B may be operated against *any* pressure of steam. For low pressure steam heating, where no more than 10 pounds of steam are carried, as little as *one and one-half* pounds of air pressure will operate the valve perfectly.

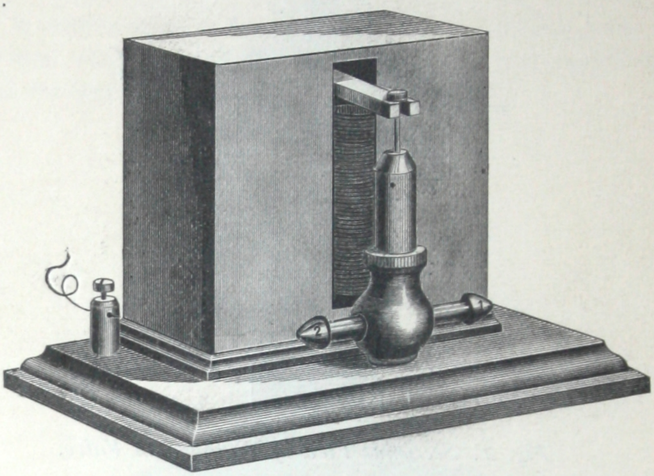

Fig. 3. Electro-Pneumatic Valve.

We will now proceed to explain how the compressed air is admitted to the diaphragm K. The pipe M leads to the Electro-Pneumatic Valve (Fig. 3) and is attached to the nipple marked 2. For this purpose we use a rubber pipe, whose inside diameter is one-eighth inch, but which is sufficiently thick and strong to stand 75 pounds pressure per square inch. This Electro-Pneumatic Valve is fastened to the wall or floor, usually near the diaphragm valve (Fig. 1). The nipple marked 1 is connected by a short rubber tube to the iron gas pipe which leads to the reservoir of compressed air, usually located in the basement of the building. The same ⅛ inch gas pipe leading from the reservoir runs to the farthest part of the building. Whenever it is necessary to operate a valve, a T is placed in the gas pipe and the short rubber pipe attached. One of the electric wires is seen at the left. When the Electro-Pneumatic Valve operates, the compressed air passes freely through it from the nipple 1 to the nipple 2, and so on to the diaphragm valve. When the electric circuit is broken, the Electro-Pneumatic Valve closes the outlet to the compressed air reservoir and opens the outlet to the diaphragm valve, which, being relieved from the pressure, opens again.

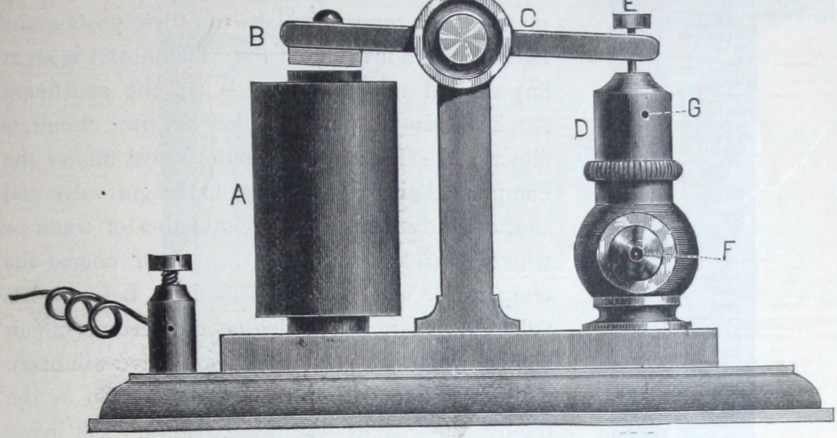

Fig. 4. Side Elevation of Electro-Pneumatic Valve.

Figure 4 is a side elevation of the Electro-Pneumatic Valve, showing the electro-magnets, the armature, the lever moved by the armature, and the piston valve which is lifted by the armature when the valve operates. One of the nipples F in this figure is turned directly toward the observer. The small hole above is the outlet port of the diaphragm valve, from which the air issues when the diaphragm valve opens. The Electro-Pneumatic Valve is small and ornamental; the base is of walnut, four inches wide and six inches long, and may be screwed to any convenient support. It operates equally well in whatever position it is placed, whether horizontally or vertically.

When the electric valve is used to control temperatures it is necessary to have some device for closing the electric circuit when the apartment reaches the desired temperature. For this purpose we place in the apartment a beautiful Thermostat shown in Fig. 5. To all appearances this instrument is a beautiful thermometer only, but the Thermostat proper is concealed

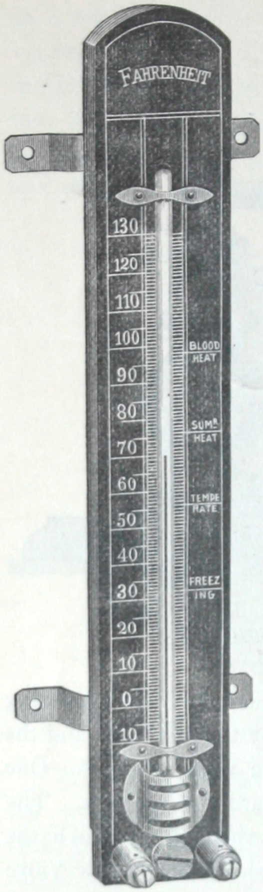

Fig. 5. The Thermostat.

behind it. The electric wires lead from the two posts on the right and left at the bottom to the battery and the Electro-Pneumatic Valve. By means of the screw seen between these posts at the bottom of the instrument the Thermostat is set at any desired temperature. When the apartment reaches this temperature the electric circuit is closed; the Electro-Pneumatic Valve allows the compressed air to enter the diaphragm valve and shut off the steam, hot air, circulation of water or whatever is the source of heat. Of course the temperature will soon begin to fall. Before it has fallen one quarter of a degree the electric circuit will be broken and the diaphragm valve will open. This operation will be repeated as often as the temperature reaches the desired limit. For living rooms we usually set these instruments at seventy degrees, but we can as well set them at any other degree desired, from zero to 212 degrees. Besides being useful in this respect, the Thermostat furnishes each room with a beautiful thermometer. When desired, we make special styles, both in regard to wood and ornamentation, to suit the finish of the room.

We employ the common gravity battery so much used on telegraph lines. Probably there are not fewer than 500,000 of them now in use in the United States. They require very little attention. They need to be cleaned about once in three months. Aside from this all the attention they require is to have a little blue vitriol dropped in occasionally and a little water poured in as the solution evaporates. We usually place the battery in the basement of the building, using from two to twelve cells, depending upon the number of valves to be operated. Where it is preferable, we have a modification of the *Electro-Pneumatic Valve*, which can be worked by an open circuit battery like the LeClanche'. This form of valve, however, is more complicated and expensive.

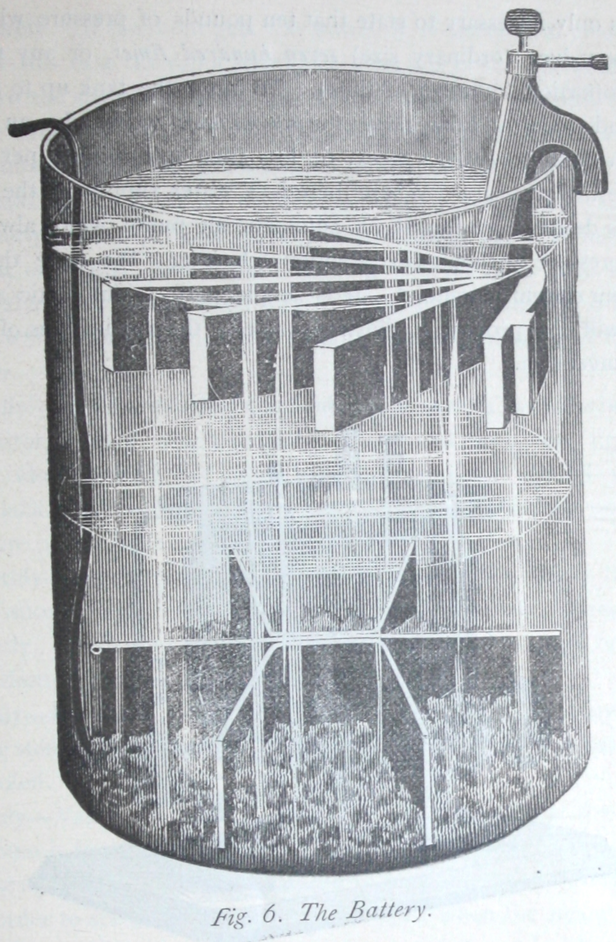

Fig. 6. The Battery.

In large buildings where there is some form of power in constant operation, as a steam or a gas engine, we substitute for the battery a small dynamo-electric machine, similar to the one shown in figure 7. The only attention which this machine requires for *years* is a few drops of oil upon the bearings. It gives a constant current with an inappreciable amount of power and with absolutely no attention.

We do not consider it essential to describe the air reservoir or air pump. They are usually located in the basement or other out-of-the-way place. The pump is simple and durable, and can be operated by a child 10 years of age. The reservoir usually has a capacity of thirty gallons and is fitted with a pressure gage. The only pumping necessary is to keep the pressure up to five pounds, never above ten pounds. To show how little work is re-

quired, it is only necessary to state that ten pounds of pressure will operate one of these valves (ordinary size) *seven hundred times*, or any number of valves a proportional number of times. To pump the tank up to a pressure of ten pounds requires from *three* to *five minutes* work. In an ordinary building, five minutes work a week, or less than one minute per day, will keep the desired pressure. Where there is a water supply in the building, and persons desire it, we furnish an automatic air pump, which always keeps up an air pressure without any attention whatever. We have thus briefly described our system in general. It is simple, perfect, automatic and noiseless. We will now proceed to illustrate some of the applications of this most wonderful invention.

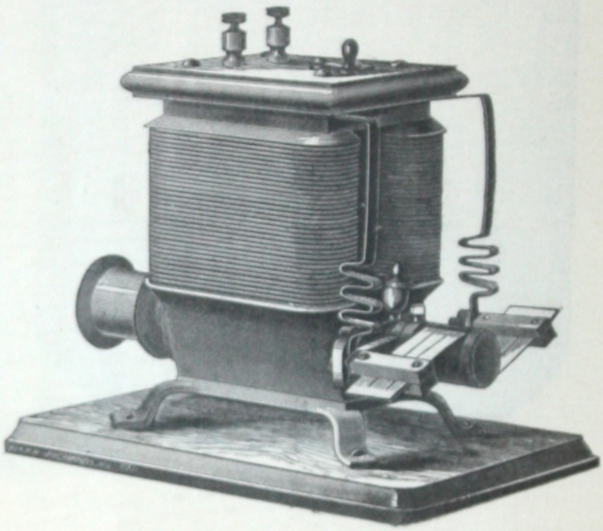

Fig. 7. Dynamo-Electric Machine.

For Steam Heating Apparatus.

The invention of the Electric Valve marks an era in steam heating; as there are numerous defects incident to steam heating which this invention entirely overcomes. Aside from these defects, steam heating is entirely scientific, as its elements can be calculated to a nicety. To show that these defects are of great magnitude, it will only be necessary to enumerate some of them:

In the first place, equal pressures give equal degrees of heat, so that in order to shut off the heat from a radiator at all, it is necessary to close the

valves entirely. If the room gets too warm, it is essential to close the valves *tightly;* in this case the room soon gets to be too cold. It is then necessary to turn the steam on again, and thus, unless the pressure of steam is accurately adjusted to the room, radiating surface and the weather, the valves require constant attention, and even then no uniformity of temperature can be kept.

Secondly—Most persons do not know that a valve should either be wide open or tightly closed, and thinking to "let in a little heat" they turn the valve open only a short way. There now arises the difficulty that the water which condenses in the radiator cannot run off and the pipes fill with water.

Thirdly—In what is called the double pipe system there are two valves to each radiator, *both* of which must be closed, and both very tightly; for if either be closed while the other is not, the radiator will fill with water. Through lack of knowledge or carelessness it often occurs that one valve will be left more or less open.

Fourthly—Do the best you can; there are but few valves that will not leak after short usage. The best of them require a man's strength to close them tightly. In closing by a screw motion they tend to grind on their seats and thus destroy them.

Fifthly—If a valve is closed never so tightly when it is hot, by the shrinkage of the stem and other parts it will leak slightly when such parts are more or less cooled.

Sixthly—Valves are often closed and forgotten, so that the next morning the room is found to be cold when it should be warm. In large buildings it is necessary for the engineer or janitor to have the run of every office and room in order to see that all the valves are open when the steam goes down.

The Electric Valve overcomes every one of these drawbacks, and has other advantages beside. In the first place, the steam is shut off when the room is **just warm enough.** With ordinary valves it always gets *too* warm before the heat is noticed and the steam turned off; and then it gets too cold before the valves are again thought of. On the other hand, the Electric Valve opens of its own accord when the temperature falls *a quarter of a degree.* The room thus has an even temperature, **never too warm,** and if sufficient steam is provided, never too cold. As the Electric Valve shuts off the steam at just the right temperature **not a pound of coal can be wasted.** This is a very important consideration, for in moderate weather it is safe to say that from one-third to one-fourth more coal is consumed than is necessary, owing to the unavoidable overheating where the ordinary hand valves are used. Saying nothing of its other advantages, the

Electric Valve **will soon pay for itself from the fuel saved.** When the Electric Valve is applied, **a radiator can never fill with water,** for the reason that the valve is always *fully open* or *fully closed.* There is no half-way stopping place. On the double pipe system we put a diaphragm valve on each end of the radiator or coil, and they both open and shut at the same time. Either one *cannot* open or shut without the other, doing the same. The valve shuts with a *piston motion,* and is held to its seat with a cushion of air having a pressure of from 50 to 300 pounds, according as the case demands. For this reason the Electric Valve never grinds and destroys its seat. It makes no difference how much the stem or other parts may shrink in cooling, the valve is just as firmly seated, for the elastic pressure will take every advantage of the shrinkage to seat the valve closer. Should the stem shrink an eighth of an inch after the valve has closed it will not have the least effect in unseating the valve. It would still be as firmly seated as ever. When the Electric Valves are applied to a system of heating **they are always all open when the steam is down.** There is no need of going about a building to see to them, for the pipes are all free and no water can collect to freeze. When the fires are started the steam passes freely to all parts of the system. A feature of the Electric Valve that is especially valuable for offices is the fact that after the fires are started in the morning and the room is warm enough, the steam will be shut off, although no one has yet arrived in the office. With the ordinary valves the temperature of the office is usually unbearably hot when the occupant arrives at 8 or 9 o'clock. Not only does the Electric Valve shut the steam off from rooms that are warm enough, but since it shuts off the radiating surface that is not needed the pressure rises accordingly and **distributes the heat to rooms which are not yet warm enough,** thus acting as an equalizer. With the Electric Valve it is possible to keep up a sufficient pressure to warm the coldest room in the building without in the least overheating any other room. For this reason alone the Electric Valve is worth ten times its cost.

Figure 1 shows the diaphragm applied to an angle valve, but we make all other forms of valve, such as globe, gate, butter-fly, etc., and each works equally well. For indirect radiation we either apply the valve directly to coils which heat the air, to the cold air box which supplies the air or to the register. When not applied directly to the coils we recommend the valve shown in figure 9, especially for large rooms where sufficient ventilation is required, as in school rooms, churches, theaters, etc. We make these valves of any size, up to three feet by five feet, closing a flue having a capacity of *fifteen square feet.* For a valve of this size we use a diaphragm of ten inches

in diameter. With an air pressure of ten pounds the valve is closed with a pressure of *seven hundred and fifty-four pounds.* The valve opens and closes without any noise and without the knowledge of any one, and by the change of the temperature of a room less than quarter of a degree.

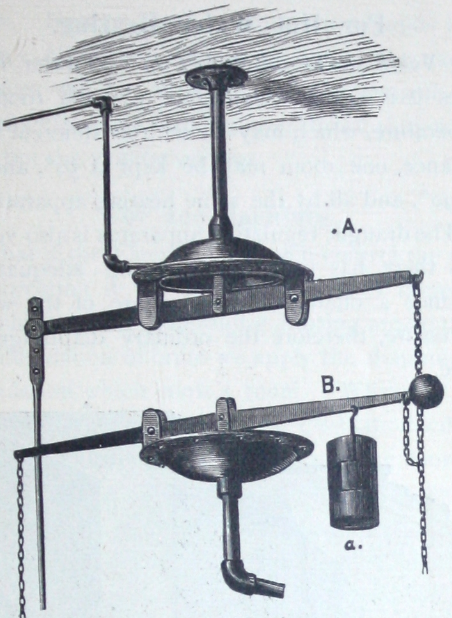

Fig. 8. Electric Diaphragm.

In dwelling houses heated mostly by indirect radiation, and where the rooms are always open, one into another, we apply the electric draught regulator to the furnace. This is shown in Figure 8. B is the ordinary diaphragm used on all systems of steam heating for controlling the draughts according to the pressure of steam. This apparatus is furnished with the weights *a*, which must be changed from day to day, to suit the weather. This controls the fire, approximately, but that is all. Above the ordinary diaphragm we suspend the electrically actuated diaphragm A, without *in the least* interfering with the ordinary diaphragm B. The electrical apparatus is attached to the same draughts as the ordinary diaphragm, but instead of regulating the fire by the pressure of steam, regulates it by the temperature of the house. When the electric apparatus is applied to the furnace the ordinary diaphragm only works when there is too high a pressure, for all of the weights are put on and kept on, *not* being changed from day to day. The electrical diaphragm has many advantages, for it is well known that the ordinary diaphragm will not work unless there is a certain pressure of steam (from one-half pound upward). There are many days in the year when a

mere vapor will warm the house sufficiently when there is no pressure. In such cases the ordinary diaphragm will not work. The electrical diaphragm, however, will work equally well when there is no steam pressure, thus controlling the fire perfectly in the mildest weather.

For Hot Water Heating.

The Electric Valve works admirably on hot water heating apparatus. For conservatories it is especially valuable, as each room can be kept at a prescribed temperature, which may be entirely different from that of other rooms. For instance, one room may be kept at 50°, another 60°, another 85° and another 90°, and all by the same heating apparatus and without the least attention. The draught regulating apparatus is also very valuable in hot water heating, as there has previously been no adequate means of controlling the fires since a change of temperature of the water does not give a difference of pressure, therefore the ordinary diaphragm used for steam heating has no use.

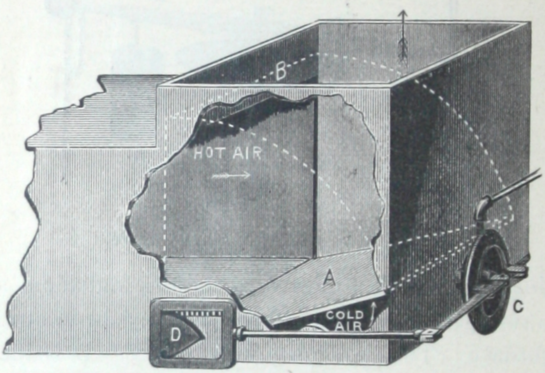

Fig. 9.

For Hot Air Heating.

We apply the Electric Valve as readily to hot air furnaces as to steam apparatus. Figure 9 shows a form of valve which is very excellent for controlling volumes of heated air. It will be seen that the hot air from the furnace coming through the horizontal pipe ascends the vertical flue. The vertical flue also opens into a cold air duct below as shown in the engraving. When the room which the air warms is below 70° (or any limit desired) the valve is in the position shown in the cut, and allows the hot air to enter, but prevents the cold air from doing so. When, however, the room arrives at seventy degrees of heat, by means of the mechanism shown, the valve A rises against the wall B, and excludes the warm air, but permits the cold air to take its place. Thus, while the temperature of the room is regulated the

ventilation is not interfered with. In very cold weather the valve may be set so that it will partly cut off the hot air and admit *some* cold air, thus reducing its temperature to any desired extent. We make these valves of *any size*, both for square and round flues. This form of valve is very valuable for school buildings. Neither teacher, janitor nor pupils have any control over the flow of air. All of the registers are out of the rooms above so that individual preferences will not interfere with the general good. Registers are often accidentally closed by walking over them, thus not only cutting of the supply of heat but the ventilation also.

For Ice Machines.

It is evident that if the Electric Valve will control the temperature of an apartment in one direction it will in another. It is therefore as useful in controlling ice machines as in controlling heating apparatus. When rooms are cooled by the circulation of brine we apply the diaphragm valve to that portion of the circulation which cools a room. Whenever the temperature of the room gets down to a certain point the circulation will be retarded and the rate of refrigeration reduced. In this way the room can be kept at *exactly* the same temperature. When several rooms are cooled by the same machine, each may be kept at its required temperature, however much that may differ from the required temperature of the other rooms. Where a daily change of temperature is required in a cooling room—for instance, one day the required temperature is 40° F., the next 38° F., the next 36° F., etc.,—we furnish a Compound Thermostat, which gives from day to day the change of temperature desired, whether it be a gradual rise or a gradual fall. Instead of controlling the circulation of the brine, the Electric Valve may be made to control the ice machine itself. This is especially valuable where the machine is required to keep one certain degree of refrigeration.

Other Uses of the Electric Valve.

For Dry Kilns. By the use of the Electric Valve dry kilns may be kept at any desired temperature. In drying valuable lumber it is often greatly injured by alternate shrinking and swelling from variations of temperature, which are unavoidable unless the Electric Valve is used. When a kiln has once reached the desired temperature, say 160°, it should never be allowed to fall below that point until the lumber is thoroughly dry.

For Bath Rooms. By means of the Electric Valve the various rooms in a bathing establishment may be kept at their respective temperatures to a nicety, dispensing with the close attention which is commonly required to adjust the heating apparatus.

For Pumps. Where pumps are used for pumping water into tanks for elevators, etc., the Electric Valve is arranged so that the pump will either slow or stop when the tank is full, and then start at the usual rate when the water in the tank falls a few inches. We apply the Electric Valve equally well when the tank is some miles from the pump as when it is in the same building.

Still Other Uses for the Electric Valve, too numerous to mention, are evident. Among them may be mentioned the operation of ventilators, windows, and traps located in inaccessible places; the opening or closing of doors and other passages of fire departments; the display of storm and other signals from high points many miles from the signal station, etc.

Prices.

It is impossible for us to give a fixed and definite price for this apparatus, as there are no two applications which would be just alike. The size of the diaphragm valves vary from three-fourths of an inch upwards. The cost of putting in the apparatus will vary with each building where it is applied. Upon application to us or our agents an estimate will be made on all work and prices will be given.

Agencies.

We establish agencies in all of the principal cities. Where such agencies are not already secured we desire to communicate with persons wishing agencies. We do not give the agency to any but reliable and responsible firms, who will give the matter proper attention. When desired, we furnish agents with a special outfit for showing the working of the Electric Valve. It consists of an elegant walnut case, containing an Air Tank, a Nickel-plated Pump, a Nickel-plated Diaphragm Valve (one inch), a Thermostat and Battery complete for use. This outfit illustrates to any one the use of the Electric Valve. Price, complete, $50, cash; weight, complete, 20 pounds.

Patents.

The Electric Valve, both singly and as a system, is fully covered by Letters Patent. These Patents are fundamental, and fully protect us. We do not license other firms to manufacture any part of the apparatus, and do not sell less than complete plants. Each Electro-Pneumatic Valve is numbered and registered, so that its whereabouts in any part of the world is known to us.

The Milwaukee Electric Mfg. Co.,
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